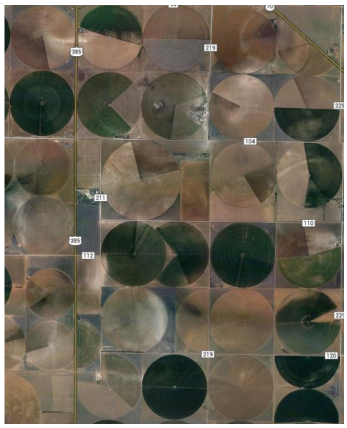

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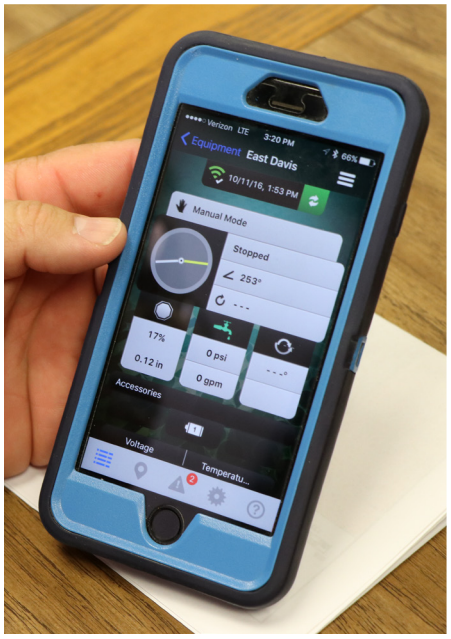


# Assistance in Irrigation Management

## 2018 Annual Report

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**This report contains information associated with TWDB Contract Number: 1713582134. Since the launch of the AIM Program, HPWD has received two additional Agricultural Water Conservation Grants from TWDB. All data and references contained within this report are for the above referenced contract number, also referred to as "AIM Round 1"**



**Questions? Contact Victoria Whitehead at 806-781-3977 or victoria.whitehead@hpwd.org**

# Introduction

Mobile data access is part of our everyday lives. This technology improves the efficiency and effectiveness of various tasks – whether it is controlling lighting, temperature, and security alarms at one's home or checking the cooking progress of a steak on the grill.

The same applies to agriculture. Telemetry-based irrigation equipment is an industry-proven product that, when used in the proper manner, can greatly assist producers with their overall water management. These devices place the next level of irrigation management in the hands of producers, allowing them to mitigate groundwater loss, monitor their applications, and make decisions on how much groundwater is required to produce their crop.

At this time, many irrigators are interested in telemetry technology. However, low commodity prices and other financial constraints present challenges for them independently funding these conservation measures. The Assistance in Irrigation Management (AIM) Program was created to close this gap. With the help of a $225,000 grant from the Texas Water Development Board (TWDB) Agricultural Water Conservation Grant Program, the AIM Program seeks to educate producers about irrigation management technology and assist them in implementing telemetry to better manage their groundwater resources.

This report shares background information on irrigation management in the High Plains Underground Water Conservation District No. 1 (HPWD). It also describes how we launched the AIM Program, our outreach and education efforts, and groundwater conservation results from the 2018 irrigation season.

HPWD would like to thank the TWDB for their commitment to programs that foster agricultural water conservation. The Agricultural Water Conservation Grant Program helps the State of Texas maintain its status as the leader in food, fiber, and fuel, while managing its natural resources for continued economic prosperity.

## AIM Round 1 Results Summary

**Total Savings**
**13,500 acre-inches**
(0.73 inches per acre)

Telemetry Systems Deployed
**154**

Participating Producers
**42**

Acres in Program
**18,400**

Irrigation System Malfunction Alerts reduced producer response time by 7.74 hours, saving
**6,372 acre-inches**

Rainfall data helped producers save
**1,093 acre-inches**

Irrigation Scheduling helped participating producers save
**6,029 acre-inches**

Producer Weekly Site Visits were reduced by
**12 visits**
helping producers conserve money and other travel resources.

# Program Overview

## Why is Irrigation Telemetry Equipment Important?

Irrigation systems in HPWD vary greatly in size and type. The most common irrigation methods in our District are subsurface drip irrigation (SDI) and center pivot irrigation. The average producer in HPWD manages numerous irrigation systems, which are often many miles apart. If there is an equipment malfunction or other problem, it may be hours before it is detected. This creates challenges when systems are operating all at once. Therefore, a vital component of irrigation management is monitoring the equipment and making timely decisions. Telemetry equipment allows producers to observe and remotely control center pivot and SDI systems using a computer, tablet or smartphone.

Beneficial features of the equipment may include:

- Start and stop irrigation
- Change direction of travel for center pivots
- Change water application depth (i.e. variable rate irrigation)
- Monitor/change fertigation rate
- Program end guns
- Create and execute irrigation plans (i.e. irrigation scheduling)
- View real-time equipment statuses such as position, pressure and flow
- Equipment malfunction alerts
- Monitor rainfall via tipping buckets
- Monitor soil moisture
- Evapotranspiration data from on-site weather stations

## Conservation Benefits for Irrigated Agriculture

There are approximately 20,127 irrigation systems covering almost 2.3 million acres within HPWD. This is split between 14,315 center pivot locations covering 1.8 million acres, and 5,812 SDI locations covering almost 0.5 million acres.

Most of HPWD is within the Llano Estacado Regional Water Planning Area (Region O). The 2017 State Water plan notes the importance of irrigated agriculture within Region O.

"Agriculture is the main economic activity in the Llano Estacado region and irrigation accounts for more than 90 percent of the projected water use in each decade of the (50 year) planning period. Drought, declining aquifer levels, and brackish groundwater are the main water quantity and quality threats to agriculture in Region O."

Industry representatives and producers have told us that telemetry equipment is the latest technology with the greatest return for water conservation. To achieve the greatest conservation impact on the groundwater supplies in this region, HPWD should assist irrigated producers by providing access to new technologies. We hope the AIM Program encourages continued adoption of the latest groundwater management technology.

# Program Research & Communication

## Industry

To effectively implement this program, HPWD must partner with producers and industry professionals. In doing so, we established a baseline for the problems producers were facing and how the program could help them reach a better conservation goal.

We started at the source by hosting two internal education sessions with industry professionals. At each session, we asked the representatives to educate our staff on equipment functions and benefits. The staff also learned more about proper installation of the equipment. These meetings helped us educate producers on the program equipment, and its benefits.

## Producer Education

Producer education played a key role during the beginning of the program. This included educating producers on the qualifying equipment, terms and conditions of the program, and time commitment. After the launch of the AIM Program, HPWD staff attended five industry meetings to share information about the AIM Program and the USDA's RCPP program with producers. Both programs provide cost-share funding opportunities for irrigation monitoring equipment.

HPWD operates multiple communication platforms. Information on the AIM Program was distributed through social media, radio interviews, email newsletters, printed newsletters, and official District press releases. District staff also mentioned the AIM Program during public presentations to civic clubs and other organizations.


**AIM Participant Jonathan James on the cover of HPWD's annual magazine, Conservation Connect. The article is included in Appendix B of this report.**

## Publications

### News Releases

- 8/30/17: All AIM Program Cost-Share Funds have been Claimed
- 11/20/17: RCPP Funds Available for Irrigation Monitoring Equipment (AIM is mentioned here.)

### *The Cross Section* (Newsletter)

- 8/2017: Irrigation system monitoring equipment now eligible for HPWD cost-share funding
- 9/2017: AIM Program Funds Claimed
- 11/2017: HPWD will apply for additional TWDB funds for 2018
- 12/2017: RCPP funds available for monitoring equipment (AIM is mentioned here.)

### *County Communicator* (County Advisory Committee Newsletter)

- 8/2017: Irrigation Management Equipment Cost-Share Program
- 9/2017: AIM Program Cost-Share Funds Have Been Expended
- 11/2017: HPWD Applies for Additional AIM Funding

### Social Media (Facebook & Twitter) & Radio

- 8/23/17: HPWD's Victoria Whitehead discusses our new Assistance in Irrigation Management Program with KGNC's Doug Hammett: http://ht.ly/RyTN30eCDSM
- 8/25/17: Limited funding remains for the AIM program. Fill out your electronic application today! http://ht.ly/alEV30eGxpW
- 8/30/17: We are thrilled to announce that all AIM Program cost-share funds have been claimed: http://ht.ly/xyaO30eNtta

# Program Launch & Administration

The District launched the AIM Program on August 17, 2017. We received more than 180 applications in the first fifteen days of the program. The available funding was sufficient to fund 154 of the applications, representing 42 producers.

## AIM Program Workflow

- HPWD receives the producer's application.
- HPWD staff assess the applications for qualifying equipment.
- HPWD staff draft interlocal agreement for each equipment location.
- Applicants are notified of their acceptance into the AIM Program and the amount of cost share funding available.
- Applicants agree to participate in the program and abide by the terms and conditions.
- Participants then have sixty days to install equipment.
- HPWD field staff visit the site and collect equipment information.
- HPWD staff process reimbursement request from TWDB.
- TWDB reimburses HPWD for 50% of equipment cost.
- HPWD reimburses participant for 50% of equipment cost.
- Participants report annually to HPWD through AIM website.

As soon as an interlocal agreement was completed, the producer was able to purchase and install the equipment. Once installed, the producer scheduled a field inspection of the equipment.

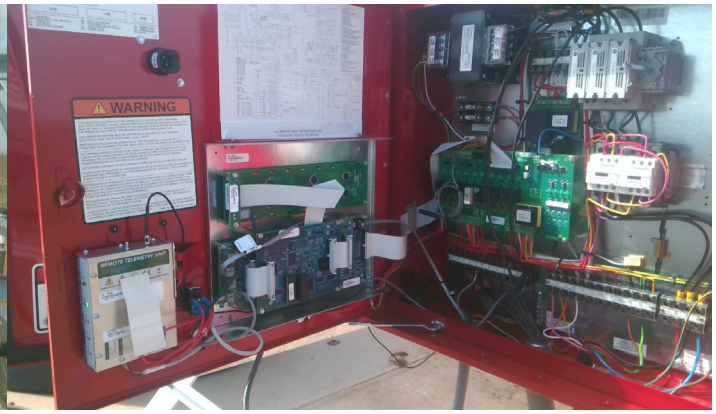
HPWD staff inspected the equipment and collected required data. This included location, photos and serial numbers for each piece of equipment. The field staff also assessed proper installation at each location.

# AIM Program Equipment

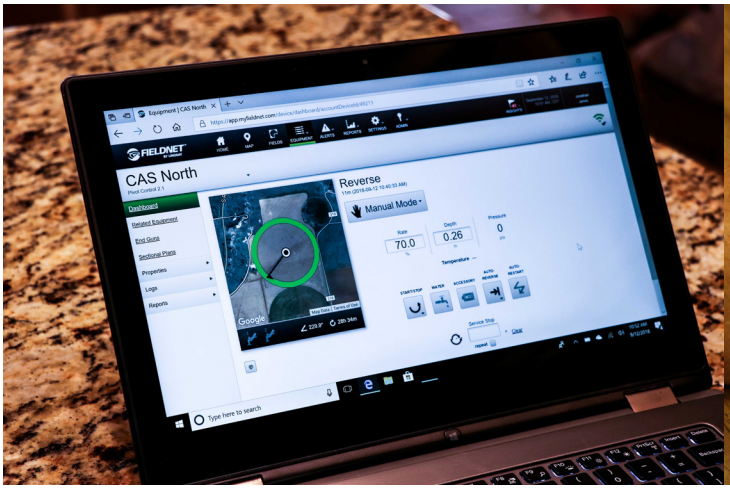
Typically, AIM equipment includes control panels (remote telemetry units, or RTUs), pressure transducers and rain buckets.

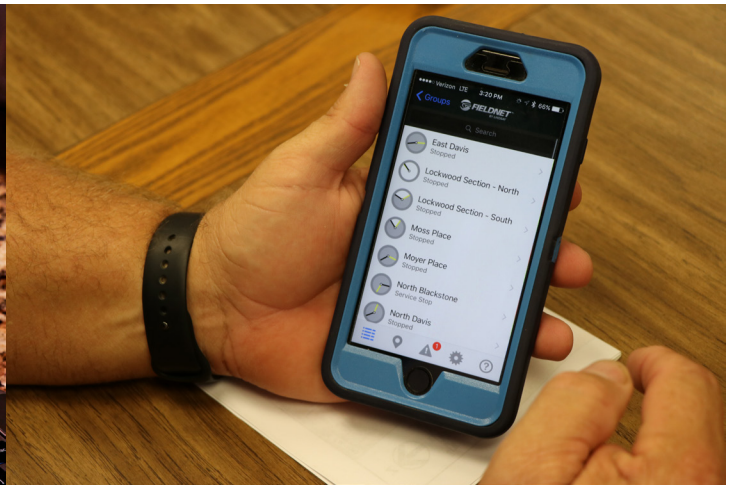
## Control Panel

This is the backbone of the system. The control panel is installed at the irrigation site, and is the communication hub that receives a variety of inputs. These inputs may be hard wired, or wireless. The control panel processes the various inputs and transmits the data to the user. The data transmission occurs via internet connection, frequently using a cell network. A "standard" control panel typically provides remote monitoring only. An "enhanced" control panel allows the user to remotely adjust or configure certain components. In this case, the user has true remote management of the irrigation system.



## Pressure Transducers

These monitor irrigation system pressure. Producers know the designed operating pressure for the irrigation system. Variability may indicate malfunctioning pumps or problems with the water distribution system. SDI frequently includes three transducers. These are installed before the filtration system, after the filtration system, and at the distribution manifold.

## Tipping Bucket Rain Gauges

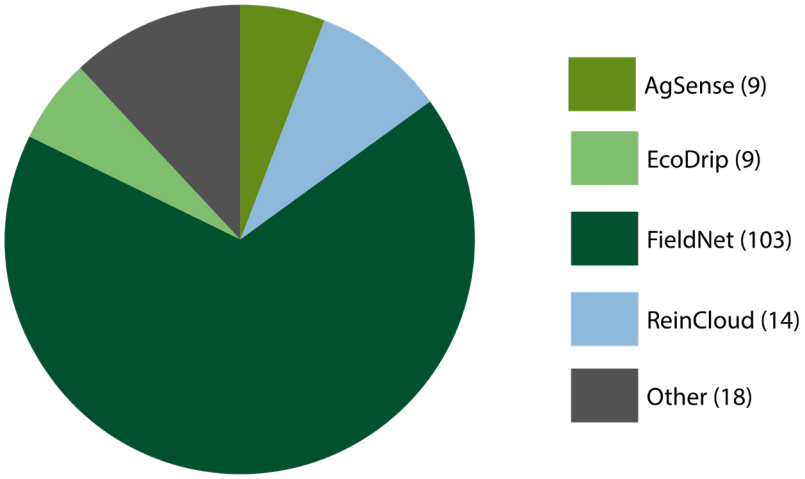
Rainfall is highly variable, both spatially and in intensity. Monitoring rainfall at the field level using a tipping bucket is one of the most accurate measurements possible. Producers may adjust or possibly terminate an irrigation using this data.

## Equipment Functions & Features

Most systems featured in AIM Round 1 are manufactured by four irrigation equipment companies: AgSense, EcoDrip, FieldNET by Lindsay, and ReinCloud™.

The most common models include:

- AgSense Lite
- AgSense Crop Link
- AgSense Field Commander
- FieldNET Boss Vision
- FieldNET Pivot Control
- EcoDrip ECIII Pro Irrigation Management System
- ReinCloud™ RC10




AGSENSE

The AgSense Field Commander is installed at the end tower of the pivot. It has patented GPS technology to provide real-time information about its position and to enable precise control of the pivot's speed, direction and more. Your favorite smart device is your bridge to all of these remote monitor and control options, and even when you're not watching, customizable text message and email alerts can keep you informed the rest of the time.

ECO-DRIP

EcoDrip's ECIII controls and monitors irrigation settings, filter flushing, irrigation and fertilizer pumps, VFDs, Valve/Gate states, and flowmeters. Utilize the latest sensor technology to acquire real time data from crops, soils, local climates, and irrigation systems. Maximize labor, energy, and water use efficiencies. Save time and resources by promptly responding to critical system failures.

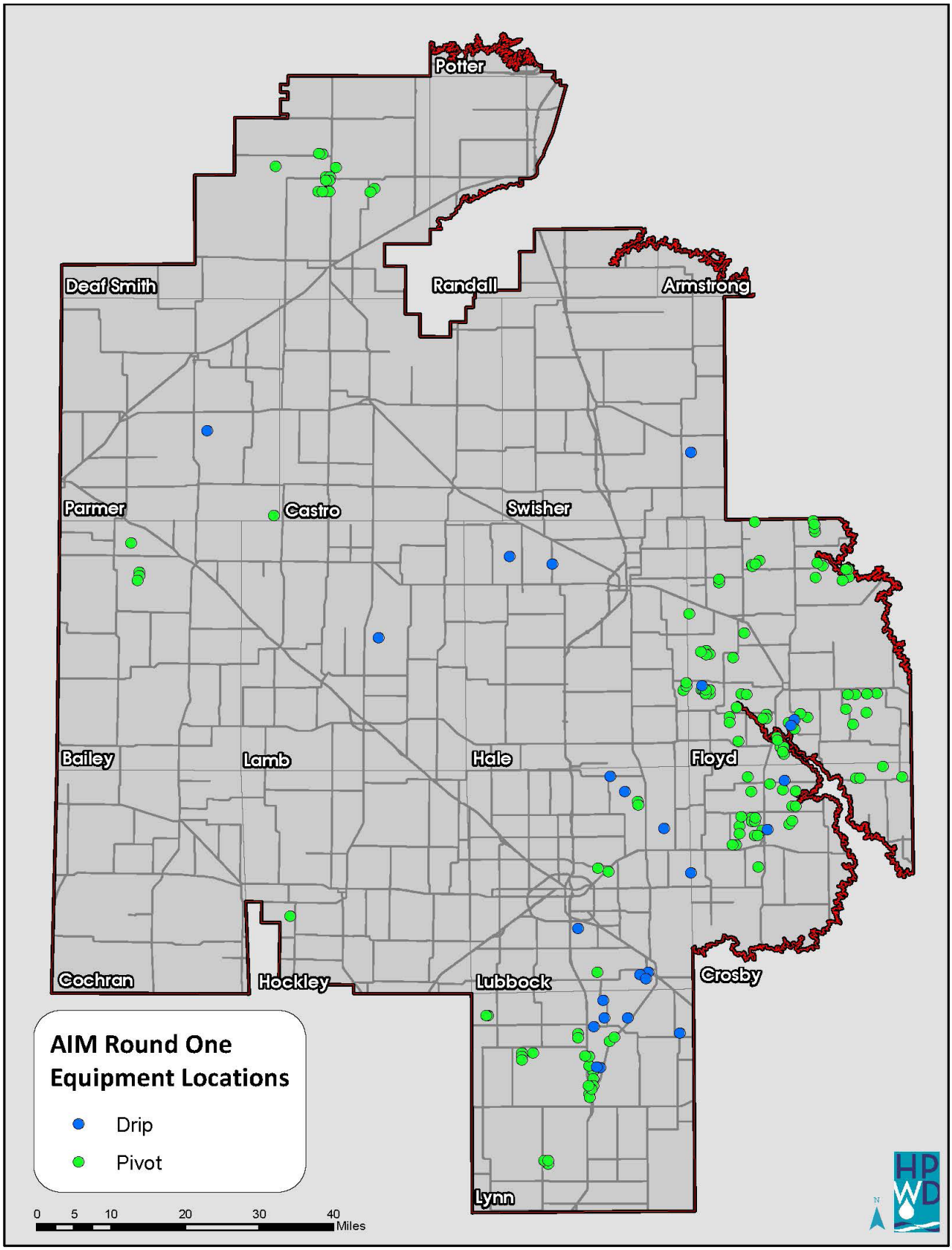
FIELDNET™ BY LINDSAY

FieldNET lets you view all of your pivots and laterals simultaneously, giving you a clear, comprehensive update on the status of all your irrigation equipment. Clicking or tapping on a pivot or lateral takes you to a dashboard for more-in-depth control and monitoring. FieldNET can monitor and record everything from water and energy usage to rainfall and temperature. It provides valuable information and trends to make better decisions and have greater control of your operations.

ReinCloud

The ReinCloud™ RC10 mobile dashboard puts you in total control from any smart device and integrates seamlessly with nearly all irrigation systems. Options for features such as sector programming for forward and reverse functions, end gun and auxiliary programming. RC10 can provide you with the right data, making it easy for you to make better, more informed decisions when it comes to your operation.

## AIM Location Map

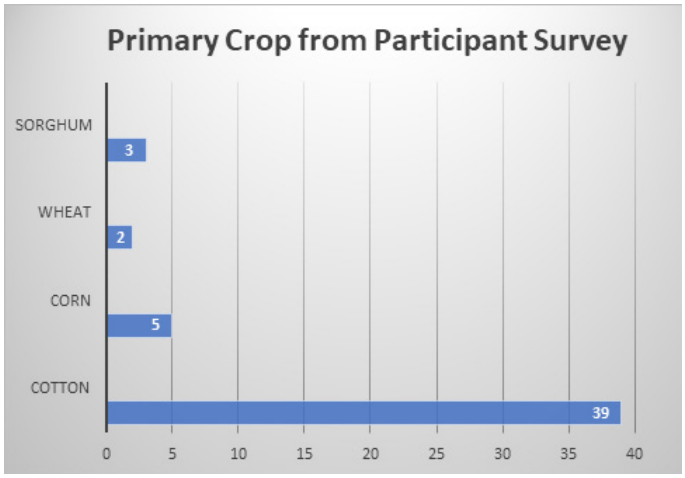


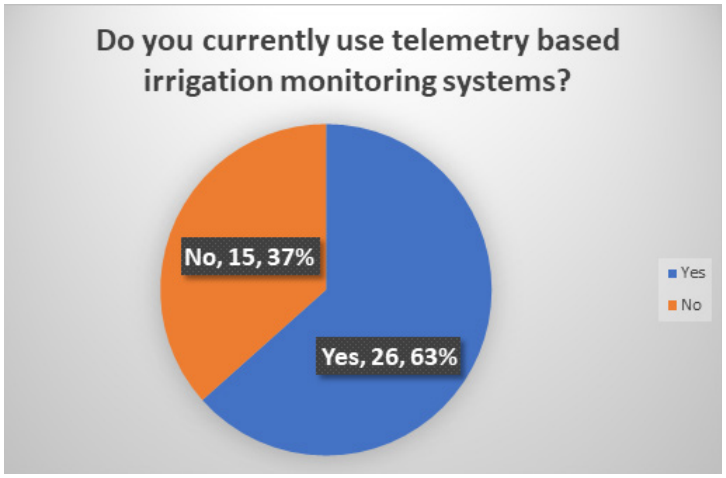

*This map indicates the locations of the 154 AIM Round 1 equipment.*

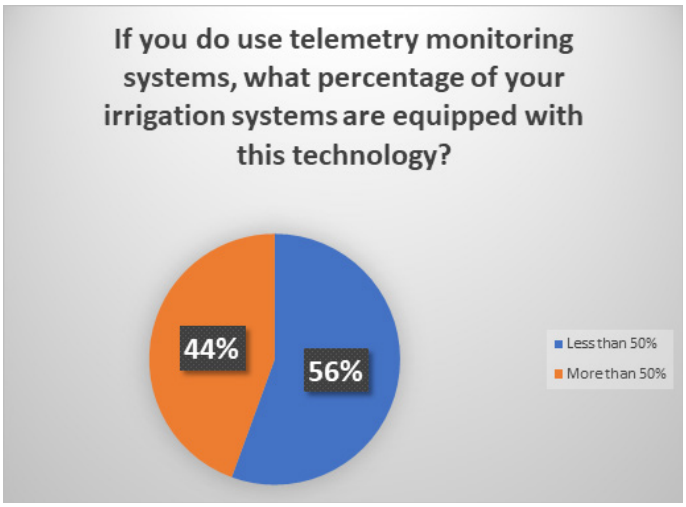
# Program Analysis & Results

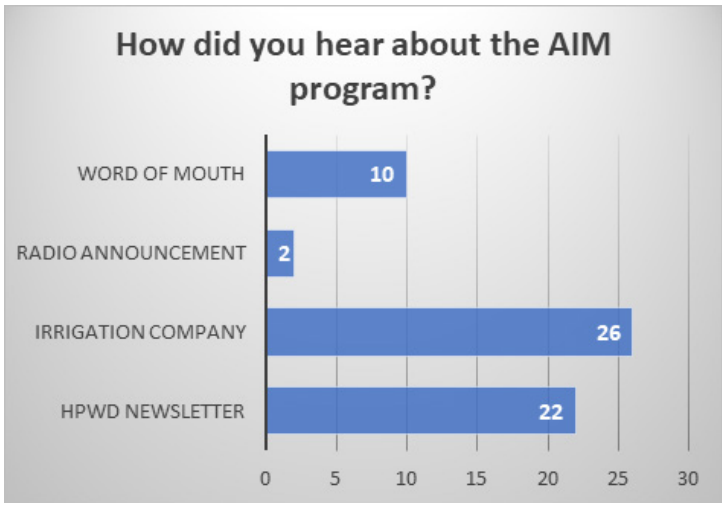
## Participant Data

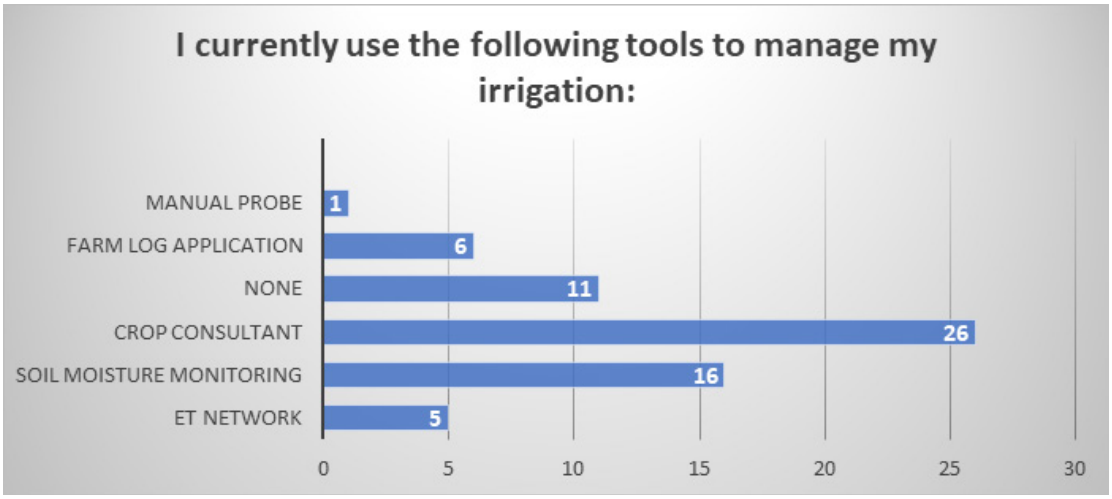
During the application process, HPWD collected information from the applicants to learn more about their current operation. The results of the survey are presented here.



## Methodology for Calculation of Estimated Water Savings

Participating irrigators reported their information to HPWD at the conclusion of the 2018 irrigation season. This helps quantify the conservation benefits of the AIM equipment.

HPWD Information Technology Administrator Gray Sanders developed a reporting tool on the AIM web site, which now serves as the main database for administering the program.

Below are the questions from the reporting tool. Where applicable, we also note the designation of the variable for our calculation example.

1. Crop type
2. Irrigation system delivery rate (gallons per minute, "A")
3. Number of irrigation system malfunction alerts this growing season ("B")
4. Average response time to system malfunction prior to installing equipment (hours, "C")
5. Average response time to system malfunction after installing equipment (hours, "D")
6. Does your equipment include irrigation scheduling assistance?
   a. If "yes", did you use this feature during the growing season?
   b. Estimated number of inches saved using the irrigation scheduler? ("E")
7. Number of times a rain alert gave you opportunity to shut off the irrigation system ("F")
8. Average response time to shut down irrigation following a rain event, prior to installing equipment? (hours, "G")
9. Average response time to shut down irrigation following a rain event, after installing equipment? (hours, "H")
10. Number of visits to this field prior to installing equipment? (per day)
11. Number of visits to this field after installing equipment? (per week)
12. Has this equipment been a good investment?
13. Would you purchase more of this equipment?

The responses to these questions allowed us to calculate the estimated amount of water conserved.

We developed the reporting tool calculations to evaluate and compare water use before and after the installation of telemetry equipment. All of the participants also operate irrigation systems without telemetry, and they know their response time to equipment malfunctions and rain events. We used the "control" response times versus the telemetry-equipped response times to calculate a portion of the water conservation benefits.

**Example** *(Note: 1 acre-inch=27,154 gallons)*

1. Cotton
2. 350 gpm (A)
3. 8 malfunction alerts (B)
4. 4 hours (C)
5. 0.25 hours (D)

$$\text{Malfunction Alert Subtotal} = \frac{[(C-D)*60*A*B]}{27154} = \frac{[(4-0.25)*60*350*8]}{27154} = 23.20 \text{ acre-inches}$$

6. 0.75 inch (E)
7. 3 rain alerts (F)
8. 2 hours (G)
9. 0.50 hours (H)

$$\text{Rain Alert Subtotal} = \frac{[(G-H)*60*A*F]}{27154} = \frac{[(2-0.05)*60*350*8]}{27154} = 3.48 \text{ acre-inches}$$

Water Conserved Total = *Malfunction Alert Subtotal + Rain Alert Subtotal + E* =
23.20 + 3.48 + 0.75 = **27.43 acre-inches**

# 2018 Irrigation Season Results

## Irrigation System Malfunction Alerts

HPWD analyzed the water savings reported by the participants and found the total water savings to be about 13,500 acre-inches. About 18,400 acres are irrigated using the equipment, so the average savings is about 0.73 inches per acre.

Table 1 contains a summary of the malfunction alerts.

*TABLE 1 Average Response Time to Irrigation System Malfunction Alerts*

| Average Malfunction Response Time Prior to Installing Equipment (hours) | Average Malfunction Response Time After Installing Equipment (hours) | Average Number of Malfunction Alerts | Conservation from Improved Response Time to Malfunction Alerts (ac-in.) |
|---|---|---|---|
| 9.11 | 1.37 | 5.85 | 6,372 |

The equipment alert features are very useful, and improved the response times by almost eight hours, as shown from the responses. The number of equipment malfunctions depends on the age of the equipment, number of power outages, and other factors.

## Rainfall Events

Table 2 contains rainfall data obtained from the participant survey. When adequate rainfall occurs, it is possible to shut off an irrigation system and conserve water. Depending on the crop type and stage of maturity, the definition of "adequate", however, will vary considerably.

*TABLE 2 Average Response Time to Rainfall Events*

| Average Rainfall Response Time Prior to Installing Equipment (hours) | Average Rainfall Response Time After Installing Equipment (hours) | Average Number of Rainfall Alerts | Conservation from Improved Response Time to Rainfall Alerts (ac-in.) |
|---|---|---|---|
| 6.19 | 1.49 | 1.81 | 1,093 |

The 2018 growing season was very dry, and much of the District experienced prolonged drought conditions until the late fall. However, we still noted water savings overall, and most importantly, an improved response time of almost five hours. During years of increased rainfall, we expect these numbers will be much higher.

## Irrigation Scheduling

Irrigation companies now offer weather data and crop models that help producers decide when to irrigate. The user must submit the crop type, soil type, and date of planting for various crops, as well as the irrigation system capacity (gpm) and irrigated acreage for each unique field. These scheduling services are typically purchased as subscriptions, which require additional costs. We expect that more irrigators will use this type of service as the technology improves.

A significant number of AIM participants purchased equipment that incorporates irrigation scheduling

assistance into their telemetry system. Almost one third of AIM participants reported use of this feature during the 2018 crop year. This information is presented in Table 3.

*TABLE 3 Estimated Conservation from Using Irrigation Scheduling Assistance (if equipped)*

| Does Your Equipment Have Irrigation Scheduling Assistance? | Did You Use the Irrigation Scheduling Assistance? | Conservation from Irrigation Scheduling Assistance (ac-in.) |
|---|---|---|
| 53 | 45 | 6,029 |

## Producer Time Require to Manage Irrigation Systems

The final portion of the reporting concerns the amount of time required to manage an irrigated farming operation. We know that irrigators spend an enormous amount of time and money managing irrigation wells and systems. Changes in weather, crop fertility needs and crop growth management are just several factors that make agriculture so challenging in this area. Because the telemetry equipment provides alerts for system malfunctions, rainfall alerts, and other benefits, producers may improve their bottom line by decreasing time and expense of frequently visiting systems. Table 4 contains the results from this portion of the survey.

*TABLE 4 Producer Time Required to Manage Irrigation Systems*

| Average Number of Weekly Visits to Irrigation System Prior to Installing Equipment | Average Number of Weekly Visits to Irrigation System After Installing Equipment |
|---|---|
| 16.52 | 4.24 |

As expected, the required number of visits to irrigation systems after installing the AIM equipment dropped significantly. The AIM participants noted their confidence in the monitoring features of the equipment, and how much labor, water, fuel, and expense they saved by reducing the number of trips to each site.

# Conclusion

The first year of the AIM Program has shown that this technology can save water, even in a very dry year. Since the launch of the program, HPWD has received two additional cost-share funding grants from TWDB which will fund AIM Round 2 and AIM Round 3. HPWD looks forward to continuing this program, learning from our producer and industry partners, and working together to provide conservation benefits to the High Plains region.

# Appendix

## Apprendix A: AIM Program Informational Flyer


Irrigators within the High Plains Water District (HPWD) service area can now apply for up to 50 percent cost-share for the purchase price of irrigation system monitoring equipment through the Assistance in Irrigation Management (AIM) program. The AIM program is a result of a $225,000 grant from the Texas Water Development Board's Agricultural Water Conservation Grant Program. Cost-share funding is limited to purchase price of equipment and is not available for data plans, installation, labor cost or taxes.

### Qualifying Equipment

The AIM program is available for telemetry equipment connected with center pivot sprinklers and subsurface drip irrigation systems. All monitored data must be transmitted by telemetry to a hand-held device such as a smart phone or tablet. Options for the program include:

**Center Pivot Irrigation Systems**

- System operation: on/off
- System motion and direction
- Current position
- System operating pressure
- Rainfall monitoring system with automatic recording rain gauge
- System flow monitoring

**Sub-Surface Drip Irrigation Systems**

- System operation: on/off
- System drip zone valves operating
- System operating pressure
- Rainfall monitoring system with automatic recording rain gauge
- System flow monitoring

### Producer Requirements

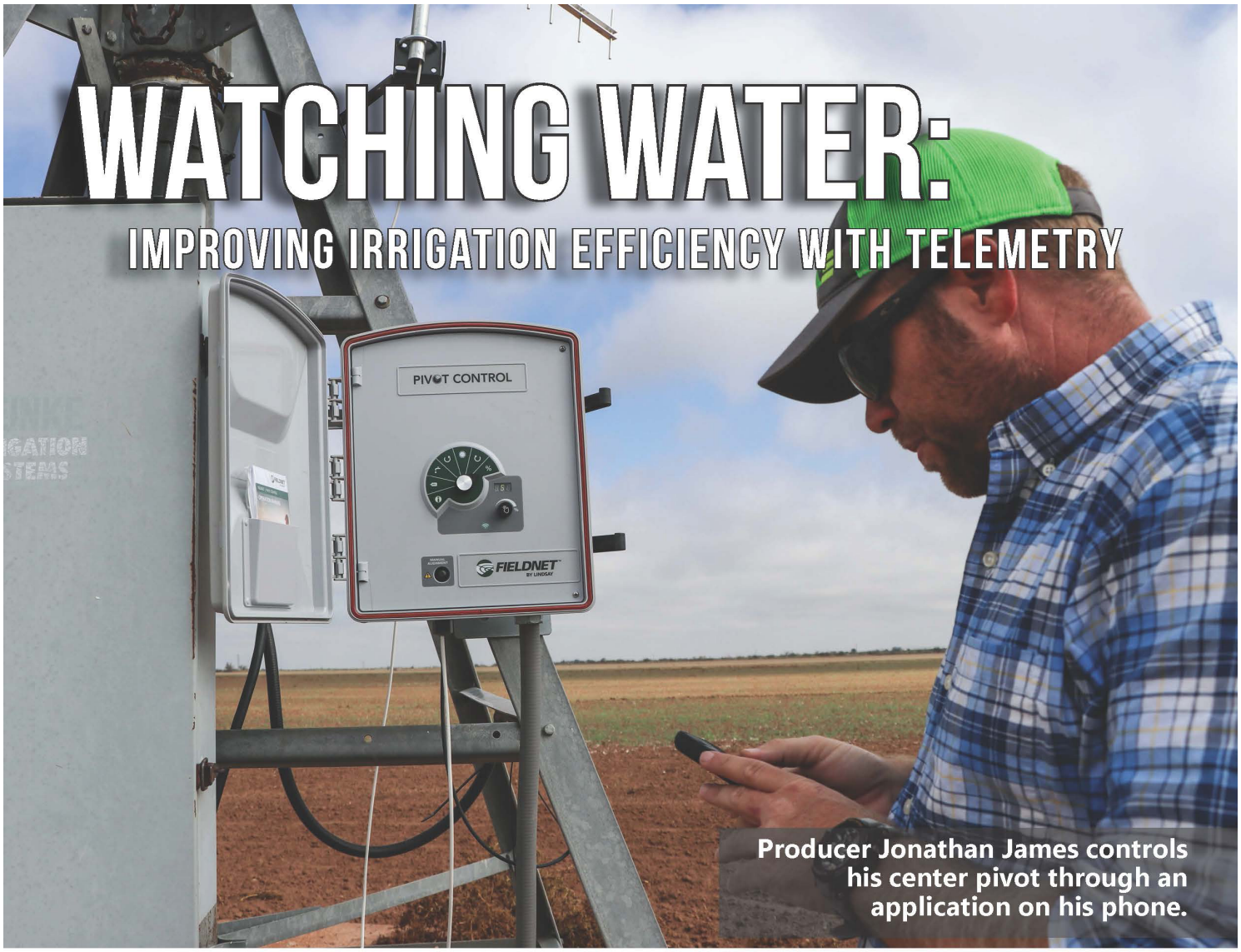
- Must farm within HPWD service area
- Must complete application & agreement
- Must provide equipment receipt to HPWD
- Must provide all data requested by HPWD
- Must ensure that all equipment is maintained and repaired if damages occur

**Find more information about AIM and applications at hpwd.org/aim**

**Questions? Contact Victoria Messer Whitehead at the HPWD office, 806-762-0181, or email victoria.messer@hpwd.org**

**High Plains Underground Water Conservation District | hpwd.org**
806.762.0181 | 2930 Avenue Q | Lubbock, TX 79411

Texas Water Development Board




# WATCHING WATER:

## IMPROVING IRRIGATION EFFICIENCY WITH TELEMETRY

Producer Jonathan James controls his center pivot through an application on his phone.

*Article by Katherine Drury*

There have been many advances in irrigation technology during the past century. Low Energy Precision Application (LEPA) center pivot systems and subsurface drip irrigation have taken the place of furrow irrigation with open, unlined ditches. With irrigation application efficiencies nearing 100 percent, researchers and irrigation equipment manufacturers are turning their attention to improved system monitoring and scheduling.

Telemetry technology, allowing remote monitoring and control of center pivot and subsurface drip irrigation systems, is an emerging trend among producers. The most basic systems allow the producer to remotely monitor an irrigation system and turn it on or off by clicking a button on his phone or computer. The more advanced telemetry systems can incorporate soil moisture information and weather data to help a producer schedule irrigation.

Jonathan James, a cotton and wheat producer in Floyd and Crosby Counties, utilizes monitoring technology on his irrigation systems. He said this equipment has been a valuable addition to his operation. "Mrs. FieldNet," as James' wife calls it, frequently sends him text messages about the status of his irrigation systems. This keeps him in the loop, if a system fails.

Earlier this summer, he and his family were about to take a day trip out of town. As always, he checked his irrigation systems that morning before leaving.

"I drove by a system with one of the monitors on it," James said. "Everything was fine. The monitor said it was fine. Visually, it was running."

He drove to check on the final center pivot. After ensuring that it was working properly, he turned around to go home before leaving town.

"That one pivot that I had driven by ten minutes earlier texted me that it had shut off," he said. "I

stopped by and had it fixed in about 30 minutes. If I had been without the monitoring system, the pivot would've sat there for 24 hours before I made it back again."

He estimates that he could have lost upwards of half a million gallons of water down the turn row had he not been immediately notified of the irrigation system malfunction.

James manages 19 center pivots. He drives about three hours every day to check on each of his fields and irrigation systems. He said this telemetry equipment helps him prioritize his route.

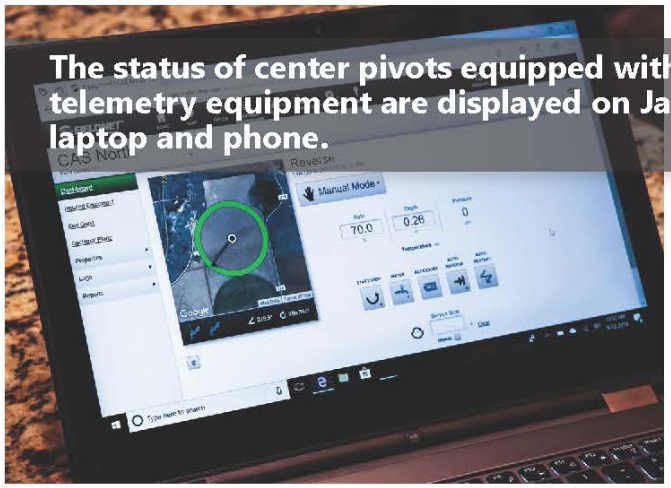
"I farm from north of Lorenzo to south of Dougherty. It takes me about three hours to make a circle to see every one of them. I still go to every one every day, but if I get up and see that one is off, I know I'm going there first and then make my circle rather than going around and showing up there at 11 o'clock. That's another four or five hours it might have saved me."

He said irrigation systems can shut down for a variety of reasons, which range from getting stuck in the mud to power surges. He estimates that on average, one of his systems malfunctions every day during the irrigation season. The ability to remotely communicate with his irrigation systems has been invaluable.

"The amount of time that it saves you and the information you collect from it is such a useful tool."

Telemetry allows producers to track when their systems were turned on or off and how long they are in operation. This data can be exported and evaluated with each data point serving as an opportunity to learn and refine the process for next season.

"Efficiency is the name of the game in farming. Every year, we're trying to squeeze just a little more and a little more, and this increases my efficiency of keeping machines running." ■




**The status of center pivots equipped with telemetry equipment are displayed on James' laptop and phone.**

## AIM-ING FOR EFFICIENCY

HPWD has received a total of $375,000 from the Texas Water Development Board for cost share funding for the Assistance in Irrigation Management (AIM) program since 2017. The first round of funding was claimed in less than two weeks. The second round of funding was gone within three days.

"Based on past producer interest, we knew that these funds would be claimed very quickly," said HPWD General Manager Jason Coleman. "The HPWD Board of Directors commends these producers for their interest in this equipment. Purchasing and installing these devices can help conserve groundwater."

AIM is a voluntary cost share program that helps producers with the purchase price of telemetry-based irrigation monitoring systems used with either a center pivot system or subsurface drip irrigation system. This equipment allows remote monitoring of irrigation systems in order to detect problems or make adjustments during rainfall events.


High Plains Water District

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